MEETING MINUTES (FINAL)

CITY OF TUCSON HABITAT CONSERVATION PLANS
Technical Advisory Committee (TAC)
Wednesday, October 1, 2008, 1:00 – 4:00 p.m.
U.S. Fish & Wildlife Service, Tucson Field Office
201 North Bonita Ave, Suite 141
Tucson, AZ 85745

ATTENDEES

City of Tucson (COT) Habitat Conservation Plans (HCPs) Technical Advisory Committee (TAC) members present:
Marit Alanen (U.S. Fish & Wildlife Service)
Dennis Abbate (Arizona Game and Fish Department)
Rich Glinski (Arizona Game and Fish Department – *retired*)
Ries Lindley (City of Tucson – Tucson Water Department)
Guy McPherson (University of Arizona – School of Natural Resources)
E. Linwood Smith (EPG, Inc.)

Other Attendees present:
Amanda Best (Westland Resources, Inc.)
Jamie Brown (City of Tucson – Office of Conservation and Sustainable Development)
Matt Clark (Defenders of Wildlife)
Mike Cross (Westland Resources, Inc.)
Cat Crawford (U.S. Fish & Wildlife Service)
David Jacobs (Arizona Attorney General's Office / Arizona State Land Department)
Glen Knowles (U.S. Fish & Wildlife Service)
Dennis Kubly (U.S. Bureau of Reclamation – Salt Lake City office)
Carolyn Laurie (Tierra / Arizona State Land Department)
Leslie Liberti (City of Tucson – Office of Conservation and Sustainable Development)
Christina McVie (Tucson Audubon Society / Coalition for Sonoran Desert Protection)
David Taylor (Tierra / Arizona State Land Department)

1. Welcome, introduction, and TAC Charter

2. Review of TAC meeting minutes:

Draft minutes were not available for review

3. Updates

Review of Preliminary Draft Greater Southlands Habitat Conservation Plan (HCP)
Jamie reminded Technical Advisory Committee (TAC) members that comments and edits to the Greater Southlands preliminary draft HCP will be due to him on October 24, 2008. He noted that

members of the City of Tucson's (COT) Resource Planning Advisory Committee are also reviewing the preliminary draft and have the same deadline.

Desert Tortoise habitat model validation request for proposal

Jamie reported that two proposals were received for work to validate the on-the-ground accuracy of Pima County's Desert Tortoise habitat model in areas of the Greater Southlands HCP planning area. He also described the funding constraints given that the Segment 2 Grant will end on December 30, 2008 and that only $25,000 had been allocated for surveys and studies as part of the Segment 3 grant. Given these constraints, Jamie said that if TAC members think that Desert Tortoise surveys could be begin in the fall and still be reliable and informative, then the COT staff recommendation would to proceed as soon as possible so that some of the Segment 2 Grant funds could be used. If not, then City staff recommend tabling the topic until the next TAC meeting when more time could be allocated to the discussion.

Matt asked about the purpose of the model validation in terms of informing the Greater Southlands HCP conservation measures. Jamie said that mitigation measures have not yet been developed, but lands considered Desert Tortoise habitat could be subject to those measures. So, the purpose of the validation is to ensure that the habitat footprint is accurate.

Marit asked if it wouldn't make sense to define the habitat, whether or not it is occupied. Instead of needing to see sign of Desert Tortoises, identifying the key habitat features and their location in the HCP planning area. Matt said that that is the same point he brought up in a recent Resource Planning Advisory Committee (RPAC) meeting, which is that presence/absence is a limited technique in determining suitable habitat. Identifying areas with the habitat characteristics is more valuable. Jamie said that the proposals address three components: Observations of habitat characteristics, desert tortoises, and desert tortoise sign.

There was some debate and disagreement among TAC members about the validity of fall Desert Tortoise surveys. Therefore, Dennis A. said that he would like more time to consider the proposals before releasing the funds to proceed. Also, Linwood said that he will contact Roy Averill-Murray of the Arizona Game and Fish Department to get his opinion about the use of fall surveys.

4. Discussion

Adaptive Management

Guest speakers Dennis Kubly of the Bureau of Reclamation (BOR) and Glen Knowles of the U.S. Fish and Wildlife Service (USFWS) were present to share information about Adaptive Management.

Dennis Kubly
(Presentation slides available at: www.tucsonaz.gov/ocsd/docs/CMS1_034607.pdf)
Dennis K. said that he and Glen would do a "tag-team" approach in which he starts by introducing the topic of Adaptive Management using Glen Canyon Dam – a BOR facility on the

Colorado River – as an example. Dennis K. said that Glen will transition to talk about the interaction or interjection of Adaptive Management into Habitat Conservation Plans (HCPs).

Dennis K. began by saying that in his years of experience with Adaptive Management, it is no longer sufficient just to be a biologist. One has to also be a psychologist and sociologist as well. It is often said that the "Management" in Adaptive Management is more about managing people than it is about resources. Not that one is in control of the process, but a big part of the communal, committee-based management process has to do with how well one can interact with other people, understand their points of view, and show respect for these points of view.

Dennis K. said that the differing views of nature are pretty well known. On one extreme, there is a bio-centric/Arcadian view of nature where the earth's resources are seen as limited. Also with this view, there is an obligation to protect taxa other than humans. In addition, environmental problems have to be looked at holistically. On the other extreme, there is an anthropocentric/imperial view of nature, which sees nature as both hostile and containing ample resource reserves. This view sees these resources as existing solely for human use and environmental problems can be solved analytically. He said that recognizing where people are on the continuum between these extremes is an important part of interacting with them.

Dennis K. said that it is also important to talk temporally about changing views in society to understand why we are where we are today. Looking back to 1956, Dwight Eisenhower was reelected and it was the year that Congress passed the Highway Act. In addition, Fidel Castro began his revolution in Cuba, Elvis Presley was driving Rock and Roll, and the Colorado River Storage Project was enacted. The Colorado River Storage Project Act authorized the building of several dams in the upper Colorado basin so that these waters could be developed and the flow of Colorado River water could be regulated. This was to ensure that the water that was dedicated to the lower basin according to the Colorado River Compact could be delivered and reclamation could be provided in the arid and semi-arid western United States.

Dennis K. said that a lot of this water is used to irrigate agriculture, control floods, and generate hydropower. The revenue generated from hydropower is used to pay for the reclamation of the arid and semi-arid lands. In 1956, there was little attention to environmental laws, which wouldn't come until twenty years later. However, David Brower, the leader of the Sierra Club, was very much against building dams. Floyd Domini, of the BOR, had a different worldview, which included building dams. He said that the BOR's existence revolved around dams and, to conservationists, they were seen as evil since they interrupt free flowing water. Conservationists contended that the BOR would not be satisfied until every river in the West had been dammed. So there was a strong polarization over the building of dams. Today, one finds the Colorado River Basin highly-developed and, as a result, there are losses of fishes.

Dennis K. said that there are four programs dedicated to the recovery of these fish. These include the Upper Colorado River Recovery Implementation Program, the San Juan Program, the Glen Canyon Program, and the Lower Colorado River Multi-Species Conservation Plan. All of these are dedicated in some way to one or more of these big river fish, which include Humpback Chub, Bonytail, Razorback Sucker, and Colorado Pikeminnow.

Dennis K. said that the project area for the Glen Canyon Dam Adaptive Management Program extends from Lake Powell downstream 280 miles, passing through Glen Canyon National Recreation Area and Grand Canyon National Park. He asked rhetorically that if one needed to decide today where to locate a dam, would that person place it in the middle of a National Recreation Area and upstream of one of the seven wonders of the natural world? Today, that would invite a tremendous amount of controversy. So, he said that that is why it is intriguing to consider what people were thinking about in 1956.

Dennis K. said that Glen Canyon Dam is a concrete arch dam that began operation in 1963. It backs up 26.5 million acre feet of storage in Lake Powell and has a capacity for about 1,323 megawatts of power, which is worth about $130,000,000.00 per year in 2008 dollars. With the construction of the dam, there was controversy from the beginning, starting with resistance from David Brower and others. The white water river running industry tried to sue the BOR in the 1970s, which was rejected by the courts. In 1982, the BOR wanted to make changes to the dam turbines and attempted to do an Environmental Assessment. There was enough controversy that they were forced to begin planning for an Environmental Impact Statement (EIS), which was undertaken in 1989. In 1992, Congress told the BOR that they were not moving quickly enough on the EIS and passed the Grand Canyon Protection Act, which required completion of the EIS and laid the foundation for the Adaptive Management Program. Additionally, the USFWS issued a jeopardy Biological Opinion in 1994. In 1996, the Secretary of the Interior signed the Record of Decision that did not embrace the reasonable and prudent alternative of the Biological Opinion, but agreed to test that scope under Adaptive Management. In 1997, a federal advisory committee was formed and the Adaptive Management Program began.

Dennis K. said that the Grand Canyon Protection Act is an important addition to other major laws passed in the 1970s such as the Clean Water Act, the National Environmental Policy Act, the Endangered Species Act, and the National Historic Preservation Act. The Grand Canyon Protection Act directed the Secretary of the Interior to operate the Glen Canyon Dam to mitigate effects and protect the resources in Grand Canyon National Park and Glen Canyon National Recreation Area. Dennis said that while general sentiments about natural resources changed over time, the Dam was required by federal law to generate hydroelectric power and provide water to the lower basin states.

Dennis K. said that there are many driving influences that must be considered in all of the decision making, such as white water river running, which is a major industry in Grand Canyon National Park. Also, the Record of Decision carved out about 20-30% of the hydroelectric power load. There was a trout fishery established in the tail water below the dam at Lee's Ferry and, today, Lee's Ferry is a world class trout fishery. The endangered Gila Chub, Humpback Chub, and Razorback Sucker are also driving influences. Another factor includes the Native American cultural artifacts buried in the fine sediments, which are carved away by the "clean, hungry" Colorado River. There is only about 10% of the sediment that used to make it into Grand Canyon from upstream because of the impoundment of the river by the Dam. As one reads the 1996 Record of Decision, one sees that there is really nothing negative and all resources would benefit from the proposed alternative, the "modified, low fluctuating flow" alternative. And, yet, there was controversy, as there were nine alternatives. The USFWS disagreed with the proposed alternative and there was a jeopardy opinion. There was a stalemate and the Secretary of the

Interior had to make a big decision. He agreed to move ahead with the proposed alternative, but the compromise was to institute Adaptive Management.

In contrast to Adaptive Management, Dennis K. asked what other decision-making approaches could be used by agencies and other, high-level policy makers. If one looks at the range, the approaches increase in complexity and require greater amounts of time, money, and individuals from diverse backgrounds. On one extreme of the decision-making approach spectrum is the political or social approach where one feels that he or she has all the power and doesn't need anyone else's opinion. That person feels that he or she is in a political or social position to make unilateral decisions and does. The monitor and modify approach suggests the need to gather more data and perhaps modify the approach over time if unhappy with the results. Adaptive Management is more complex and is often characterized as a six-stage process.

With Adaptive Management, it is important to have a combination of managers, scientists, policy-makers, and stakeholders. Stakeholders are individuals who have a vested interest in the outcome and participate. The process typically begins with a workshop where people assess the problem, asking, "What are the issues here?," "What's the dissention over how the system will be managed?," and "How does it work conceptually?" This results in the need to create a graphical representation of the system, identify the possible management actions necessary, and identify desired outcomes. Another question is "What is the causal relation between proposed actions and desired outcomes." Dennis K. said that once all of these have been described, a management plan needs to be designed and implemented. Out of the monitoring component, there are results with resource responses to the action. From this, there is an evaluation stage in which all of the groups are reconvened to make a judgement on whether or not to continue with the next iterations. Dennis K. noted that working for an agency characterized by an engineering focus, this is almost considered an anathema since engineers are used to laying things out, constructing the item, walking away, and then going to the next project.

Dennis K. advocated that the COT's HCP Technical Advisory Committee (TAC) consider the structure of the decision-making, such as lines of communication. In the case of the Glen Canyon Adaptive Management Program, there are 25 members from the seven Colorado River basin states. This includes representatives from the USFWS, two power user groups, two utility consortia, two recreational user groups, five Department of Interior agencies, one Department of Energy agency, five Native American tribes, and two environmental groups.

Dennis K. said that one of the major challenges of Adaptive Management is the interface between science and politically-motivated decisions. He said that they start their decisions with the Grand Canyon Monitoring and Research Center – an independent science institution under the United States Geological Survey (USGS) – working with the technical work group, which includes the same members as the federal advisory committee. They devise the experiments with the help of independent review panels and a standing group of science advisors, including some of the most eminent scientists in Adaptive Management who are repeatedly providing input on the design of the experiments.

Dennis K. said that the process is not entirely scientific. Politics get involved, but there are scientific leanings to the recommendations that go to the Secretary of the Interior. The Secretary

invokes his or her authority under the Grand Canyon Protection Action Act, delivers a decision to the program, and its implemented. A majority of the committee's recommendations have been budgetary in nature or address experimental design. They have not really moved to the policy stage. In large programs like this, policy decisions are the ultimate goal. He referred to a slide with the classical six-step process to Adaptive Management, which includes assessing the problem, developing hypotheses, conducting experiments, monitoring results, evaluating effects, and passing recommendations along.

Dennis K. said that he would encourage the COT to think about lines of communication and structure so that the COT knows who is going to make decisions as far as the Technical Advisory Committee is concerned. This is very important to the success or failure of the process. He added that developing a vision and mission statement is the first step. For the Glen Canyon Adaptive Management Program, under the vision and mission statements there are nine principals, 52 management objectives, and a host of information needs. These are all interjected into work plans. However, he said that quantitative objectives do not yet exist and that has been one of the challenges of the program. It has been ten years into the process and the group is now just starting on developing a list of desired future conditions.

Dennis K. spoke of the four metrics or criteria identified in the Department of Interior's Adaptive Management Technical Guide (www.doi.gov/initiatives/AdaptiveManagement/TechGuide.pdf). In terms of knowledge improvement, some of the things that appear to work well are to have an independent group conduct the science. So, Dennis said that they have maintained high quality science by maintaining competition through the USGS formal bid process. Early on, the program enjoined the services of Carl Walters in the development of a conceptual model, which is a graphical representation of how the system works. The group also has science advisors to provide peer review.

In terms of experiments, the first took place in 1996 with the release of 45,000 cubic feet per second for about seven days. The increased flow removed the fine sediments of the beaches. Within a year, people were talking about the failure of this experiment. In 2000, they ran a hydrology that was similar to the reasonable and prudent alternative recommended by the USFWS. This occurred around the same time as the Enron energy debacle when the price of energy was very high. The energy industry said that they would never allow it again because it could not have happened at a worse time. In 2002, there was a competing hypothesis that not only were flows important, but also that non-native fish were important in terms of the downward trends of native fish populations. So, mechanical removal of non-native fish was added to the hydrology to be released in 2004.

In terms of the Adaptive Management Program for the Glen Canyon Dam, Dennis K. said that another thing they have done is look at what they think they know. Adaptive Management is about identifying and managing uncertainty, which helps prioritize where to allocate money and monitoring emphasis. Dennis said that they brought together seventy scientists and managers and created categories ranging from highly certain to highly uncertain. Where they could, they identified these categories in both direction and magnitude. Then, they looked at the supporting data. With this, they created a knowledge assessment matrix for food-based fish, which is one of the sub-models. When this was done in 2005, it suggested that there is still a lot unknown about

the impacts of the dam and it operation. Given this, Dennis K. said that creating knowledge assessment matrices would be an excellent starting place as it puts everyone on a common foundation with a scientific basis.

Dennis K. said that he sees a difference between compliance with some of the federal environmental laws and Adaptive Management. Compliance with federal environmental laws is often task oriented so if there is an agreement to survey a population and this survey occurs, then credit is awarded despite whether or not the resource responds in the predicted way. In contrast, Adaptive Management places more emphasis on resource responses and whether or not these responses occurred under the proposed management action. With Dennis K.'s work, there were predictions about aquatic productivity in the tail water and that by raising the minimum flow aquatic productivity would increase. This came to pass. The endangered Humpback Chub, which had been declining, stabilized. Responses from other native fish seem to indicate that they are also increasing in numbers in recent years.

The cause and effect relationship is difficult to determine. He said that they could hypothesize that the increases in native fish are from warm water dam releases. However, mechanical removal of non-native fish could be a cause of the increases. Another thing they have done is translocate Humpback Chub from one part of the Little Colorado River upstream to a part that was previously uninhabited. Those 1,500 Humpback Chub have had good survivorship. As these examples indicate, there are many confounding effects and so it may be preferable to use weighted efforts instead of classical statistical tests.

In 2002, Dennis K. said that they started coupling tributary inputs with mainstem releases, allowing the sediment to build up to a high level. From the figures he showed, Dennis K. said that they get a good reaction with each of the high flow events, but the subsequent result is that the river has its way, carves away the beaches, and sediment levels drop. This is not unexpected, yet it is a challenge for the program because the maintenance of those beaches is very important to river running interests.

Dennis K. said that, in terms of legal implementation, from the beginning Environmental Assessments have been allowed because, with Adaptive Management, generally everyone is on the same page with what they are trying to do. Looking into the future, he said that what they have done recently is National Environmental Policy Act (NEPA) and Endangered Species Act (ESA) compliance on a five year plan from 2008 to 2012, with an increased emphasis on modeling. In contrast to modeling, he said that large-scale field experiments are not only very expensive, there is also beginning to be more resistance to them from members of his committee. This resistance may be due to vested interests being fearful that it will become policy if too many experiments are done. From the resource managers, Dennis K. said that they are seeing more interest in being able to move beyond experimentation and research and putting things into management actions.

Glen Knowles
(Presentation slides available at: www.tucsonaz.gov/ocsd/docs/CMS1_034608.pdf)
Glen said that he has been working with Dennis K. for about five years on the Glen Canyon Adaptive Management Program and so he said that he has a pretty good idea of how Adaptive

Management should work in theory. He added that there is a lot of misunderstanding about how Adaptive Management should be applied, although it is getting increasing refined as time goes on. He said he hoped to give the audience a sense of what Adaptive Management is from a Department of the Interior (DOI) perspective and how it might be applied in a land-based HCP context. By the end of the presentation, Glen said that he hoped that the group would have a sense of the costs and benefits of Adaptive Management.

In terms of background on HCPs, Glen said that in the early days of the Endangered Species Act, some said that the ESA had a major flaw. This was that Congress did not put enough thought into the intersection of private property rights and "take" of listed species as defined in the ESA. This was brought to light through a project called San Bruno Mountain in the San Francisco Bay area, which was a development proposed on private property. There was no way of getting around the fact that the project was going to "take" habitat for listed butterflies. So, in 1982, Congress amended the ESA to allow for Incidental Take Permits (ITPs) as part of Section 10 of the ESA. With this amendment, if one has an approved HCP and Incidental Take Permit, one can move forward with otherwise lawful activities that may result in "take" of listed species. Glen recommended to keep in mind that an HCP is not just a procedure where one fills out an application, gets a permit, and proceeds with the project. Instead, the process should result in a climate of conflict resolution, creating partnerships and cooperation.

Glen said that there are some things that can be learned from the first HCP. The San Bruno Mountain project drove the need to amend the ESA and create the ITP process. The main players were San Mateo County, local municipalities, and the company proposing the project. Once the ESA was amended to allow for HCPs and ITPs, the company completed an HCP in 1983. At that time, the HCP allowed for developing 800 acres and setting aside 1,700 acres, conserved for native grasslands. The HCP also included measures to restore native grasslands that had been invaded by non-native species to create habitat for the listed butterfly. But, in looking back on it later, the players involved had little understanding of whether or not the HCP was successful. One reason for this is that those involved did not do a good job of applying Adaptive Management. This was probably because Adaptive Management hadn't really come into being yet. But, long term monitoring wasn't really part of that first HCP either. Because of this, it was difficult to assess the success of the HCP. Glen said that he thinks if they would have utilized Adaptive Management, it would have prevented a lot of this lack of understanding.

With the USFWS "Five Point Policy" that amended the HCP Handbook in 2000, one of the "points" is Adaptive Management. Glen added that dealing with the "No Surprises" clause with HCPs and Adaptive Management is a question that comes up a lot. The "No Surprises" clause, provides assurances to the applicant that mitigation requirements agreed to at the time of ITP issuance are not going to increase over time. The "Five Point Policy" states that if the range of possibilities of what Adaptive Management encompasses is described in the HCP, there is no problem since one is within the bounds of the "No Surprises" clause.

In terms of the main tenets of Adaptive Management, Glen said that the best source for this information is the DOI's Technical Guide to Adaptive Management (www.doi.gov/initiatives/AdaptiveManagement/documents.html). Glen said that many people think that Adaptive Management is simply "learning by doing," but it is more than that if one

wants it to work properly. What the DOI has said is that Adaptive Management consists of nine items carried out in that order, iteratively over a process.

Glen said that often what is called Adaptive Management in HCPs is actually contingency planning. And, in the HCP handbook, contingency planning is encouraged as part of addressing changed circumstances. That is, one should consider what to do if a changed circumstance occurs. For example, if one plans to plant 20 acres of cottonwood and willow trees and that effort fails, then contingency planning suggests that one goes to another part of the planning area and plants 40 acres of these trees. This is not Adaptive Management. Adaptive Management is a systematic approach for improving resource management by learning from management outcomes. It involves structured decision-making for addressing scientific uncertainty. But there has to be some kind of decision to be made, and, more importantly, one has to be able to change that decision over time. So, if there is just one decision to make and one cannot ever revisit and revise that decision, then one shouldn't try to apply Adaptive Management to that situation.

Rich said that one of the things the TAC should do is think about whether or not the TAC is proposing contingency planning or Adaptive Management. Unless we buy-in to everything that is required for Adaptive Management, then we are not doing Adaptive Management. In response, Glen said that Adaptive Management is not a requirement of HCPs, although it is recommended for certain situations. In addition, he wanted to clarify that his description of how Adaptive Management can fit within HCPs is his alone and didn't want to speak for the local USFWS staff.

Glen said that there are two types of Adaptive Management, passive and active. In passive, only one management action is chosen and then one alters the action based on this. In active, one chooses to implement a range of actions and tries to learn from them based on the monitoring and models, but also based on how they compare and contrast with each other. So, Glen said that one of the keys is stakeholder involvement. Adaptive Management should seek to engage stakeholders in all aspects of the project and facilitate a commitment to learning from land based management with stakeholder input.

Another key element is institutional support. One needs to define who the decision-makers are in the framework and how information gets to them. For HCPs, it is important to have a long-term commitment of institutional leadership in place and having that organize stakeholder input and adjust management based on information.

In terms of management objectives, Glen said that these are always a part of an Adaptive Management process as well as an HCP process. Glen mentioned some management objectives developed for the Town of Marana's and the COT's HCPs. In thinking about the COT's objectives, he said that they are a good start but recommends that the TAC work to define them as much as possible. One example Glen mentioned was to "provide breeding and foraging opportunities for burrowing owls," which he said begs the question of what constitutes good habitat and how many owls should be supported. These are difficult questions to answer but if they can be answered, the COT will be better off over time. This feeds back to assessing the success of the HCP. Glen also recommended that the COT have management alternatives as

well, even if there is no plan for implementing them. This helps in defining the modeling. So, it is good to think about how the COT's actions affect the resources the COT is concerned about.

Glen said that another key component of Adaptive Management is modeling. Most of the big Adaptive Management programs rely heavily on modeling. For small Adaptive Management applications, modeling should also be used. Modeling should characterize system behaviors and responses to management actions. That is, if an action is taken, how will it effect the resource? It should incorporate different hypotheses about how the resource is going to respond, it should capture key uncertainties, and should be calibrated as much as possible to currently available data. If the data is currently unavailable, modeling can help define the monitoring program to get the data. Modeling can be viewed as an automatic knowledge assessment because, in building the model, one quickly discovers what one knows and what one doesn't know.

In considering a model for the Western Burrowing Owl, Glen developed a list of question areas that would need to be addressed. These included genetic considerations, known viable population size, what constitutes a good habitat and corridors, and other considerations. Once some of this information is gathered, decision support systems like Geographic Information Systems can be used to test alternative reserve design locations, for example.

In terms of monitoring, it is an important part of Adaptive Management and a requirement of HCPs. Monitoring should be objective based when consider the questions that monitoring should answer. Variables to be monitored should be defined as well as the frequency, timing, and duration for each. How variables will be analyzed needs to be determined so that one isn't trying to apply statistical tests post-hoc. For HCPs, monitoring needs to be sufficient to detect species trends. For Adaptive Management purposes, funding and responsibilities need to be determined for the monitoring.

Mike asked if the ability to detect trends is a statutory requirement of a monitoring program. Glen said that he would defer to local USFWS staff for that answer, but said that without the ability to detect trends, the monitoring program is not informative. He said that an ESA Section 7 consultation is required to show that the HCP will not jeopardize the species.

Glen continued by saying that once monitoring is in place, there needs to be a built in mechanism to assess the findings. If using an active Adaptive Management model, one should be able to compare and contrast treatments. With passive Adaptive Management, assessment helps to compare with model predictions. One should be able to detect what the management effects are, which goes back to the monitoring scheme. Also, an assessment should be cognizant of other factors, such as climate change.

Iteration is another important component of Adaptive Management, where management, monitoring, assessment, and action are repeated. Glen recommended considering the whole cycle and how it will play out over the life of the HCP. Another important component of Adaptive Management is involving the public. He said that the public comment period is part of the HCP process and the USFWS recommends going further by scheduling informational meetings and establishing advisory committees. Glen said that he recommends going even further by institutionalizing public involvement. This would be done by planning advisory meetings

throughout the life of the HCP and having those open to the public. With the Chiracahua Leopard Frog Recovery Plan process, it involves both a stakeholder and technical advisory group, which represents a new way the USFWS is involving the public in the recovery planning process.

Glen said that he would encourage the TAC and COT to develop an Adaptive Management framework now – if it is to be used – and then after the issuance of the Incidental Take Permit, implement this Adaptive Management framework. He said that he would recommend using the same framework that is in place for the development of the HCPs, such as the Technical Advisory Committee. Glen said that if Adaptive Management is to be used, then the development of the HCP is just the beginning of the process. The real value is in implementing it as a program.

Glen said that the main benefit of Adaptive Management is learning, but the value of the information has to be high. When adaptive managers talk about the value of the information, what they mean is encompassed in the question: "If I know now what I'm going to know in the future, would I change my decision and alter my course?" If the odds of this are low, then one shouldn't apply Adaptive Management. But, it if is possible that one will learn things that will change the course of action, then it makes sense to apply Adaptive Management.

In conclusion, Glen said that Adaptive Management is not trial and error. Instead, it is a systematic approach for improving resource management by learning from what is being done. It requires acknowledging uncertainty and a long-term commitment to learning and stakeholder participation. Not doing Adaptive Management could be costlier in the future because lack of Adaptive Management may lead to poor decisions or a poorly designed monitoring approach.

Question and Answer
Matt said that there is a number of species where this is not a lot of current research available. Given that lack of knowledge, he asked Glen how one develops the treatments to test. Glen said that it sounded like the question is "What are your research questions?" and that it all feeds together with monitoring and modeling. What one wants to do is look at the objectives and create a knowledge assessment, such as what Dennis K. described earlier. Glen added that with the Glen Canyon Adaptive Management Program, they brought stakeholders and scientists together and determined what was known and unknown about how water temperature changes impact fish. As they did this, they created a worksheet that color coded the items based on the amount of information, adding a plus or minus symbol by it depending on if it positively or negatively impacted the species. By going through this process, Glen said that it would guide the determination of the questions to be addressed. Modeling is also a good way to do this and is probably why it is a prescriptive item for Adaptive Management. By building a predictive model, it uncovers what is unknown pretty quickly. Matt said that there might be a certain amount of research that needs to be done for a species, such as getting a better understanding of a species ecology, before management actions and approaches to test can be determined. Glen said that he agreed and said that one might conclude that there is not enough information to build a model. But, the process of building a model would likely lead to good questions around which to design research.

Rich said that is seemed that an important consideration when considering the use of Adaptive Management is the amount of flexibility in the management options. For example, he said "Do we have the ability to recommend that 'No, we should not manage this land here and should not develop it. Instead, we recommend putting it into a reserve.' Or, 'We recommend only developing say, 20 percent.'"? With all the public land in the HCP planning area perhaps this provides more flexibility. Chris said that that would work if there were cooperation among all entities. Rich said that with Adaptive Management, we would have it.

Chris said that that what Rich was saying is that there is just one decision to make, which is not Adaptive Management since Adaptive Management must offer the ability to change one's decision over time and be able to go back to that issue. After implementing certain development practices in an area with the mindset of "blade first, ask questions later", there is no going back when we are dealing with species that take hundreds of years to mature to ecological functionality. So, she said that the precautionary mechanism applies here.

Chris added that there are many species that have some nexus with riparian systems, yet it is the habitat type that we have done the least to protect in this state and region. With regard to riparian restoration and reconnecting those areas, this involves multi-jurisdictional cooperation. And, she added that we have to look at cost effectiveness and shared resources. The COT has the only assured funding source for any conservation whatsoever. This multi-jurisdictional issue will be very important for us, especially if disparate programs are created. She asked how to address multi-jurisdictional issues with Adaptive Management. Glen said that the question was raised at the Town of Marana's Technical Biology Meeting, but that he didn't have an easy answer. He said that maybe the best one can do is define a process describing cooperation over the life of the HCPs. He added that it sounded like there is some level of interest in what other jurisdictions are doing based on what he read of the meeting minutes. Chris said that the decisions that are made have permanent, irreparable consequences. Rich said that it is like that with the COT's Avra Valley lands. The Water Department hosts a public meeting and the public decides that they want a certain quality of water. Then, a series of decisions result from that which impacts those lands.

Jamie said that he wondered how Adaptive Management would apply specifically to the COT's HCPs given what could occur outside the planning area and beyond the COT's control. He mentioned the concept of Burrowing Owl Management Areas as part of the Avra Valley HCP and added that that the planning area is a series of both connected and unconnected parcels ranging in size, some of which are surrounded by private land. In addition to a fragmented HCP planning area, burrowing owls have been translocated and hacked in close proximity to the HCP planning area. This would likely result in artificial changes in the burrowing owl population beyond the COT's control. Given this, Jamie said that on page 15 of the Department of Interior Adaptive Management Technical Guide (www.doi.gov/initiatives/AdaptiveManagement/documents.html), it states,

> *In certain situations, a management agency can only partially influence the resource system. For example, if an agency manages a relatively small area surrounded by private land, and the Adaptive Management project applies only to the agency-managed land, management activities on the private lands may well*

dominate the effect of agency actions. In such a situation, Adaptive Management is unlikely to be useful.

With this, Jamie asked if Adaptive Management would be recommended with these BOMAs given the location and configuration of the Avra Valley HCP planning area.

Chris said that this is an edge-effect issue in terms of corridor design. The Arizona Game and Fish Department Technical Report number 20 (available at www.tucsonaz.gov/ocsd/docs/CMS1_033869.pdf) suggests that native species richness begins to decline at the threshold of developments one acre or less in size. She added that a recent report out of Colorado says that there is a minimum 600-foot edge effect, which includes disturbances from light, noise, and other factors. So, if there is wildlife corridor, then 1,200 feet are needed to get out of the edge effect, which limits what we have control over.

Leslie said that with regard to Dennis K.'s flowchart, politics are at the top and scientists are at the bottom. Thus, she said that it seems like a useful tool may be a management action assessment that considers the feasibility and flexibility of different management actions. She said that, as Chris mentioned, once one starts down a particular pathway with certain development activities, there is no going back. It either requires too much in the way of changing legislation or too much uncertainty for regulated communities to do that. She said that she thinks that it would be a valuable exercise to determine what is the feasibility in getting change in a certain type of management.

Rich said that Brian Powell of Pima County mentioned that buffelgrass management might be a good example of where Adaptive Management is clear. Glen said that vegetation management is often referenced as a good example of a clear Adaptive Management process. If one has different treatments that one wants to test, it is a good Adaptive Management tool. So, Glen said that he would encourage the TAC and COT to consider applying it to buffelgrass management.

5. Upcoming Meetings:

TAC Meetings are scheduled for November 19 and December 18, 2008 at the same time and location as this meeting.

6. Call to the Audience

There were no additional comments from members of the audience.

7. Adjournment

The meeting was adjourned at 3:50 p.m.